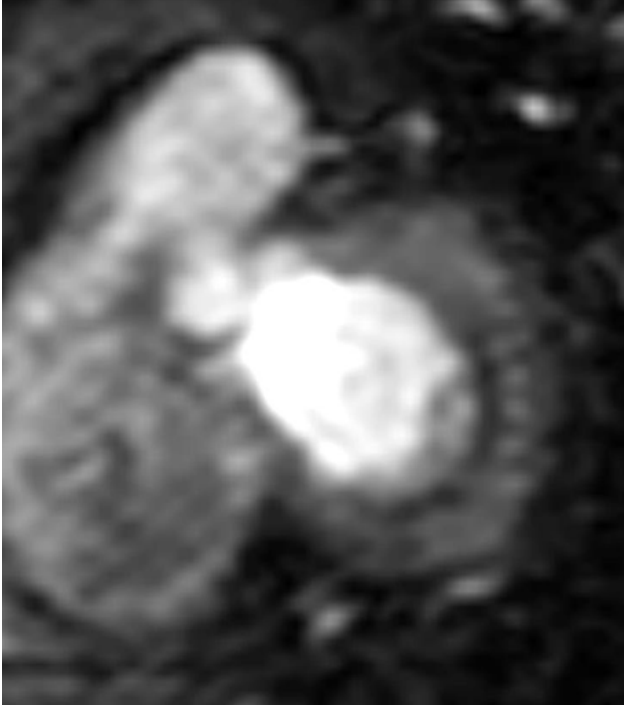potentially reduce the rate of false positive CMR results and the rate of subsequent purely diagnostic CA.

Normal variations in coronary anatomy such as left-dominant or right-dominant circulation may account for false-positive results of MRMPI in the assessment of CAD.

2026. TRADEOFFS BETWEEN SPATIAL COVERAGE AND DYNAMIC TEMPORAL RESOLUTION IN QUANTITATIVE FIRST-PASS PERFUSION IMAGING

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Introduction:

First-pass contrast-enhanced perfusion MRI is a useful tool for the diagnosis of ischemic cardiac disease. Quantitative analysis of myocardial perfusion depends on measuring dynamic signal intensity changes of the LV blood and myocardium as a function of time. There is an inverse relationship between the number of slices imaged per unit time and the repetition time for those spatial locations. For example, a perfusion sequence that can image 3 slices per heartbeat could image 6 locations every other heartbeat.

Purpose:

The purpose of this study was to show that high temporal sampling of the input function is important for perfusion quantification, but the myocardial sampling rate may be reduced and still achieve highly accurate measures of perfusion.

Methods:

Dual-bolus (Gd-DTPA 0.005 and 0.1 mmol/kg) rest and dipyridamole stress myocardial perfusion MR imaging was performed on 10 normal volunteers on a 1.5T Siemens scanner. Each perfusion study was acquired in a breath-hold and with single RR imaging interval. A segmented GRE-EPI sequence was used by the following parameters: 90° prep, 25° readout, TR 7.5 ms, TE 1.48 ms, 8 mm slice thickness, echo train length 4, acquisition matrix 128x80-96, FOV 360x270 mm. Time-signal intensity curves of the perfusion images were analyzed by dividing the myocardium into 6 sectors. Myocardial blood flow (MBF) was estimated from LV input and myocardial output time-signal intensity curves by a Fermi model constrained deconvolution. Using MBF quantified from LV and myocardial curves at 1RR temporal resolution as a reference standard, we compared MBF estimated from 2RR and 3RR under-sampled time-signal intensity curves.

Results:

Figure-1 shows an example of the LV input curve at 1RR that was under-sampled to 2RR and 3RR temporal resolutions. The shape of the curve was distorted noticeably at contrast arrival and peak contrast enhancement time points. At 3RR under-sampling, the LV curve only has 2 points above half height and clearly underestimates the peak. Figure-2 shows under-sampling has less severe effects in the myocardial curves. Table-1 summarizes the results of MBF estimated from different under-sampled LV and myocardial time-signal intensity curves. Stress MBF is systematically underestimated for 2RR and 3RR curves compared to the 1RR reference (p<0.01). However, if the LV curve is maintained at 1RR interval, under-sampling of the myocardial curve at 2RR and 3RR has much less effect on MBF estimates. Figure-3 compares the Bland-Altman plot of MBF estimates from different under-sampled 2RR and 3RR curves against the 1RR reference. The scatter increases as the temporal resolution of the time-signal intensity curves decreases to 2RR and 3RR intervals.

Conclusions:

Reduced temporal sampling of the LV blood signal intensity during myocardial perfusion imaging significantly affects myocardial blood flow estimates. Under-sampling the LV input curve to 2RR or 3RR intervals results in systematic underestimation of MBF and increased scatter of the errors. Since reduced temporal sampling of the time-signal intensity curves theoretically acts as a low pass temporal filter which suppresses dynamic contrast information, the effects are more significant for LV blood than the myocardial curves and are larger for stress than rest perfusions. However, combining 1RR temporal resolution in the LV and 2RR temporal resolution in the myocardium during perfusion imaging has minimal impact to MBF estimates and could effectively double the spatial coverage without sacrificing the accuracy of quantitative perfusion measures.
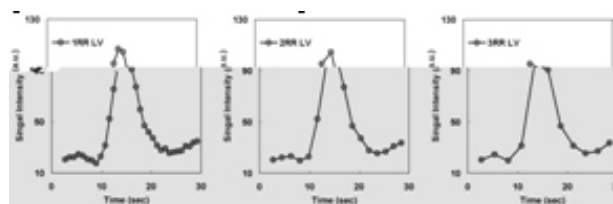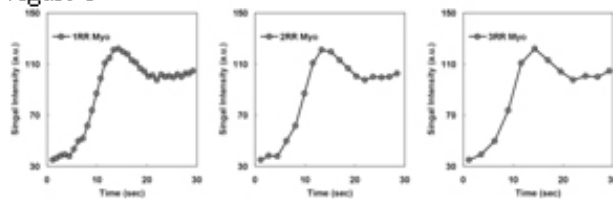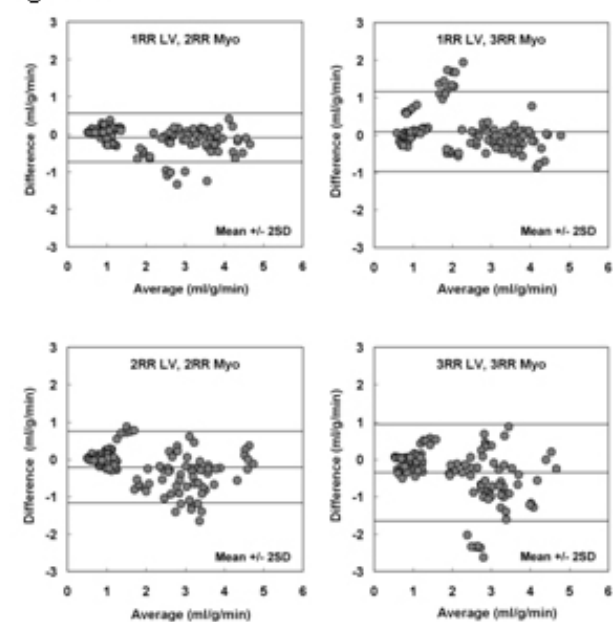
Figure-1

Figure-2

Figure-3

Table-1 Comparison of myocardial blood flow (MBF) estimates from under-sampled time-signal intensity

MBF(ml/g/min)Mean ± SD	1RR_LV, 1RR_Myo	1RR_LV, 2RR_Myo	1RR_LV, 3RR_Myo	2RR_LV, 2RR_Myo	3RR_LV, 3RR_Myo
Rest	**0.95 ± 0.22**	1.02 ± 0.21	1.27 ± 0.73	1.01 ± 0.34	0.89 ± 0.33
Stress	**3.34 ± 0.72**	3.11 ± 0.81	3.20 ± 0.74	2.88 ± 0.84	2.71 ± 0.76

High temporal sampling of the input function is important for perfusion quantification, but the myocardial sampling rate may be reduced and still achieve highly accurate measures of perfusion.

2027. ACCURACY AND REPRODUCIBILITY OF QUANTIFYING MYOCARDIAL FIBROSIS IN HYPERTROPHIC CARDIOMYOPATHY USING DELAYED ENHANCEMENT CARDIOVASCULAR MAGNETIC RESONANCE THRESHOLDING TECHNIQUES

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Background: Cardiovascular magnetic resonance (CMR) with delayed enhancement (DE) has become the gold standard for the identification and quantification of myocardial fibrosis in coronary artery disease. In this regard, DE thresholding to 2 standard deviations above normal myocardium is now considered the most robust method for quantifying fibrosis with high accuracy and reproducibility. However, whether this method is the most appropriate for non-ischemic cardiomyopathies such as hypertrophic cardiomyopathy remains uncertain. Our goal was to compare the performance of various thresholding techniques to a visual assessment in a large cohort of patients with hypertrophic cardiomyopthy (HCM). *Methods:* DE-CMR imaging was performed 15 minutes after the intravenous administration of 0.2 mmol/kg of gadolinium-DTPA (Magnevist, Schering; Berlin, Germany) with a breath-hold segmented inversion-recovery sequence (TI = 240-300 ms), in 203 HCM patients (42±17 years; 71% male) from two HCM referral centers. Two blinded, independent readers first quantified fibrosis by visual assessment then using thresholds of 2 standard deviations (SD), 3 SD,4 SD,6 SD above the mean of normal, remote myocardium, and 2 SD above noise (2 SDN). The quantification was repeated ≥4 weeks apart for reproducibility.

Results: DE was present in 51% of subjects, with an interobserver agreement of 93%. For the detection of fibrosis, 6 SD correlated best with visual assessment as compared to 2, 3, 4 SD, or 2 SDN. Average visual quantity of fibrosis was 13±20 g compared with 12±17 g at 6 SD, and 55±31 g at 2 SD, 36±27 g at 3 SD, 25±23 g at 4 SD, and 64±69 g at 2 SDN. All thresholds were significantly correlated with visual assessment, with 6 SD having the most robust correlation (r=0.913, p<0.0001) vs. 2 SD, 3 SD, 4 SD, and 2 SDN (r=0.806, 0.874, 0.905, 0.533, respectively; all p<0.001). Compared with visual assessment, 6 SD had the lowest intraobserver variability (0.6±8 g, κ=0.66; p<0.0001 vs. 1.4±9 g, κ=0.49; p<0.0001) and interobserver variability (5.4±18 g, κ=0.20; p<0.0001 vs. -18.4±18 g, κ=0.08; p<0.0001). *Conclusions:* CMR DE thresholding techniques utilizing 6 SD above the mean of visually normal, remote myocardium appears to be both an accurate and reproducible method for the quantification of myocardial fibrosis in HCM. This methodology should be considered for serial assessment of myocardial fibrosis in longitudinal HCM studies.

We showed the accuracy and reproducibility of various DE thresholding techniques in HCM patients. Utilizing a threshold of 6 standard deviations above the mean of remote myocardium in quantifying fibrosis was the most accurate and reproducibile in our cohort.